REMARKS

This Amendment is in response to the non-final Official Action currently outstanding with respect to the above-identified application.

Claims 1-58 and 63-66 now stand as being canceled, without prejudice. In addition, by the foregoing Applicants have amended Claims 59 and 61 so as to correct several minor typographical errors therein and also so as to change the term "smooth" so as to read "flat" therein thereby more particularly and distinctly pointing out the subject matter that Applicants regard as the invention. Hence, upon the entry of the foregoing Amendment, Claims 59 – 62, as hereinabove amended, will constitute the claims under active prosecution in this application.

The claims of this application as they will stand upon the entry of the foregoing Amendment are reproduced hereinabove in association with respectively appropriate status identifiers as required by the Rules.

More particularly, in the currently outstanding non-final Official Action, the Examiner has:

1. Acknowledged Applicants' claim for foreign priority under 35 USC §119 (a)-(d) or (f), and also confirmed the receipt by the United States Patent and Trademark Office of the required copies of the priority documents.

2. Acknowledged and accepted the formal drawings filed on 24 March 2005.

3. Previously acknowledged Applicants' Information Disclosure Statements.

4. Objected to Claims 59, 61, 63 and 65 on the basis that they each contain at least one typographical error. – **By the foregoing Amendment, Applicants have corrected all typographical errors noted in the claims remaining after the foregoing Amendment.**

5. Rejected Claims 59-66 under 35 USC 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that Applicants regard as the invention. – **As discussed further below, Applicants believe that the Examiner's rejection has been overcome by the change of the word "smooth" to the word "flat" in the above-amended claims. More specifically, as to the term "smooth", it is stated at page 144 that the light emitting layers are to be "as flat as possible". Also, the issue concerning what smoothness is acceptable and what smoothness is not acceptable is discussed in some detail in the examples set forth in the specification. Applicants believe that the foregoing explicit statement "as flat as possible", in combination with the experimental results concerning the smoothness of the light emitting layers formed by various numbers of droplets in the specification should be deemed to be enough to provide an adequate definition of the so-called "relative terminology" "smooth" that now been changed to "flat" in the present claims.**

6. Rejected Claims 63-66 under 35 USC 112, first paragraph, as failing to comply with the written description requirement. Claims 64-66 also are rejected for depending from rejected claim 63, and 60-62 and 64-66 are similarly rejected. – **By the foregoing Amendment, Claims 63-66 have been canceled, without prejudice. Otherwise, Claims 60-62 now depend from allowable Claim 59.**

7. The Examiner seeks confirmation of joint ownership at the time that the invention was made. – **Applicants respectfully confirm for the record that the subject matter of all of the claims was invented by all of the joint inventors and that the subject matter of all of the claims was commonly owned at the time that the inventions forming the subject matters thereof were made.**

8. Rejected Claims 59-66 are rejected under 35 USC 103(a) as being unpatentable over Seki et al (US Published Patent Application No. 2002/0067123) in view of Himeshima et al (US Published Patent Application No. 2001/009689) in view of Hawkins et al (US Published Patent Application No. 2002/0130931) in view of Chang et al (US Published Patent Application 2002/0118251) in view of Silverbrook (US Patent No. 6,284,147) in view of Akahira et al (US Patent No. 6394578).

Additional comment with respect to items 1-7 above is not deemed to be required in these Remarks.

With respect to item 8, however, Applicant respectfully submits the following comments:

In the Seki reference, the partitions 13 form regions where the hole injection/transportation layer 21 and the light emitting layer 22 are positioned. That is, the partitions 13 correspond to the barrier of the present invention. In individual regions surrounded by the partitions 13, the light emitting layer 22 is positioned on the hole injection/transportation layer 21. The cathode 23 is positioned on the light emitting layer 22. Furthermore, since the hole injection/transportation layer 21 is conductive, the top surface of the hole injection/transportation layer 21 is covered with the light emitting layer 22 so as to prevent current leakage [See, Figure 7 and paragraphs [0030] and [0034]].

In addition, in the present invention, the light emitting layer is formed flat (see Claim 59, as amended). In a display element, such flatness of the light emitting layer is desirable. Whereas in the Seki reference, as is evident from Figure 7 thereof, the light emitting layer is not flat. Further, the Seki reference does not disclose the technical idea of forming the light emitting layer flat with the use of an inkjet apparatus.

Also, Applicants respectfully submit that in the present invention, flat formation of the light emitting layer is realized in such a manner that in the step (d) of forming the light emitting layer, droplets ejected from the nozzle are dried instantly and "the droplets (are) ejected in plural times while shifting landing positions of the droplets".

Accordingly, Applicants are somewhat confused regarding the Examiner's comments on the Seki et al reference. As Applicants understand the Seki et al reference, it discloses an EL device in which at least two laminated films are formed by one or more ink jet systems, one film being a hole injection/transportation layer (a so-called "buffer" layer) and the other being a light emitting layer (the light-emitting layer being such as to completely cover the buffer layer, see paragraphs [0021], [0022], and [0034]. Further, as presently understood, paragraph [0004] of the Seki et al reference clearly indicate that the buffer material cannot be characterized as being the same as, or equivalent to, the light emitting material.

More specifically, in the Seki et al reference, the buffer or hole injection/transportation layer 16 is formed by droplets from an ink jet system and has an area or volume that is greater than or equal to **(not less than)** the area or volume defined by the so-called "barriers 12". See for example FIG 4 of the Seki et al reference wherein the dried buffer layer 16 is clearly thicker than the adjacent SiO_2 material 12. Also, even if this were not the case, the combined buffer layer and light emitting material layer ***must*** overlap the top edge of the barrier 12 so as to avoid current leakage which appears to be the main point of the Seki et al reference (see Seki et al at Paragraph [0034]. Thus, the droplets of the buffer material are intended to overflow any barrier formed by the element 12 in order to prevent leakage currents flowing through the device, and even if they do not overflow the barrier 12, the combined buffer and light emitting material layers are to do so.

Applicants respectfully submit that this is not a teaching that the barrier walls do not have to be as thick as the light emitting material that they contain. Note that the Seki et al reference seems to suggest at least in the drawings that upon initial application the droplets deposited in the spaces between that barriers 13 whether they be of buffer material or light emitting material are thicker than the barriers 13 (overflow of the barriers 13 presumably being avoided by surface tension) prior to drying. Moreover, the combined dried buffer material and dried light emitting material is not as thick as the adjacent barrier portion 12/13.

Accordingly, Applicants respectfully submit that if the barrier is considered to be the element 12, then the buffer material is to be thicker than the barrier height. However, the buffer material is not the same as the claimed light emitting material as far as we have been able to understand from the present specification and the Seki et al reference. On the other hand, if the element 13 or both the elements 12 and 13 in the Seki et al reference are considered to be the barrier, the barrier is always thicker than the ink jet deposited layer(s) adjacent thereto (not shorter than the same as presently claimed) unless one is considering the droplets as deposited prior to the drying thereof..

In this state of the case, Applicants respectfully submit that the Examiner is attempting justify his assertions that the barrier height in the Seki et al reference is not as great as that of the ink jet deposited material based upon the barrier 12 and the buffer material 21. It seems clear, on the other hand, that the light emitting material is not as thick as the height of the barrier 13. Furthermore, without a clear disclosure of that limitation of the present claims in the cited Seki et al reference, Applicants respectfully submit that the remainder of the Examiner's arguments are without sufficient foundation to justify the rejections being made in the enclosed Official Action. Stated slightly differently, the Seki et al reference discloses barriers defining an area that might be referred to as a "light emitting layer formation region" in the words of the present claims. Those barriers are formed by the elements 12 and 13 of the Seki et al reference. Droplets from an ink jet apparatus are deposited in the area defined by the barriers such that the droplets of buffer material prior to drying overfill the volume defined by the barriers 12 and 13, and after drying preferably overfill the volume defined by the barrier 12.

Then, droplets of light emitting material from an ink jet apparatus are deposited into the volume defined by the barriers on top of the buffer material layer so as to slightly overfill that volume prior to drying. Thereafter, after drying, the level of the combined buffer layer/light emitting material layer has a thickness smaller than the height of the barriers 12 and 13 together.

In further response to the Examiner's substantive rejections Applicants hereby again repeat and re-emphasize the following comments indicative of the patentable nature of the claims of this application as hereinabove amended.

Applicant respectfully submits that it will be understood by the Examiner that in the method for manufacturing an organic EL display element, with the inkjet method, it is possible to form layers for three primary colors R, G, and B simultaneously. This prevents the organic EL element from being damaged by the repeating photolithography process, and allows reduction of a production time.

Further, since the ink is only applied to a position of the color pixel, an amount of the pigment used becomes less than the amount used in the photolithography method. Thus, it is possible to realize a remarkable reduction of the material cost. Further, since it is not necessary to carry out the complicated exposure and development, a developing apparatus becomes no longer necessary. Therefore, the manufacturing cost is reduced. Moreover, since it is possible to work under a normal temperature and a normal pressure, the inkjet method appears to be more promising in improving a productivity, and in simplifying the productive facility" (see page 5, line 18-page 6, line 9 of the English specification).

However, "in the conventional inkjet method, there has not been carried out a sufficient study on how to dry the droplets ejected from a nozzle. Thus, it is known that droplets do not immediately dry after landing on a substrate. This results in a greater amount of non-dried droplets on the substrate in order to obtain a desirable layer thickness of the organic EL layer. As a result, it takes long time for drying the droplets, thereby allowing the droplets to move on the substrate before the droplets dry. This deteriorates a formation accuracy of the organic EL layer" (see page 6, lines 13-22 of the English specification).

"Reduction of the diameter of the single droplet is an option to avoid the foregoing problem" (see page 8, lines :13 and 14 of the English specification).

In this case, "the droplet 314 needs to be ejected toward the same pixel twice or more. However, after a first droplet, successive droplets land on the organic EL layer formed by a previously landed droplet. Since the organic EL layer formed by the previously landed droplet is not subjected to the liquid-affinity treatment, the successive droplets do not spread out in a desirable shape. This causes an unevenness. Further, if the successive droplets land before the previous droplet dries, the ink will spread out to the liquid-affinitive region 312 of the next pixel. Therefore, ejection of the successive droplets must be suspended until the previous droplet 314 dries.

This results in a poor productivity, Further, it is necessary to carry out the photolithography process for forming the liquid-affinitive region and the liquid-repellent region. This does not allow the inkjet apparatus to contribute to simplification of the productive facility advantageously" (see page 8, line 24-page 9, line 16 of the English specification).

Further, also in formation of black matrices (BM) in an organic EL display, "one option is to increase concentration of the droplet 314, and eject the droplets 314 at sufficiently long intervals, so that the solvent of the previous droplets is dried off by the time a final droplet is landed. However, the higher the concentration of the droplet becomes, the higher viscosity the ink has so as to be unable to be ejected by using a conventional inkjet method. Further, it is necessary to carry out the photolithography process for forming the BM. Therefore, the inkjet apparatus is not allowed to contribute to simplification of the productive facility advantageously" (see page 11, line 24-page 12, line 9 of the English specification).

In order to solve the foregoing problem, the inventors of the present application have diligently studied formation of an organic EL layer based on an inkjet method that allows easy production with simple equipment and low costs, in a method for manufacturing an active matrix organic EL display element using an electrostatic attraction type inkjet apparatus.

An object of the study is to prevent deterioration of a formation accuracy of the organic EL layer when forming one organic EL layer with a desired thickness by ejecting droplets and laminating the droplets.

As a result of the study, the inventors have found that deterioration of a formation accuracy of the organic EL layer when forming one organic EL layer with a desired thickness by ejecting droplets and laminating the droplets can be prevented by arranging such that the droplets are dried immediately after landed on an organic EL layer formation region on a substrate, preventing movement of the droplets landed on another droplet having previously landed. Further, the inventors have found that in order to dry the droplets immediately after landed on the organic EL layer formation region on the substrate, it is requested that each of the droplets ejected via the nozzle of the inkjet apparatus is 1 pl or less.

As described above, when each of the droplets ejected via, the nozzle of the electrostatic attraction type inkjet apparatus is 1pl or less, it is possible to attain a high speed of drying the droplets, high accuracy in landing the droplets, easiness in ejecting the droplets, and large number of landed droplets (high productivity). This is evident from Table 3 on page 75 of the English specification.

None of the cited references disclose the object of the present application of arranging such that the droplets are immediately dried after landed on the organic EL layer formation region on the substrate in order to prevent deterioration of a formation accuracy of the organic EL layer when forming one organic EL layer by ejecting droplets successively. Further, none of the cited references disclose arranging such. that each of the droplets ejected via the nozzle of the inkjet apparatus is 1pl or less in order to attain the object.

Specifically, Shimoda reference only discloses use of an inkjet apparatus in order to deposit an organic light emitting layer. Higashino reference only discloses changing a voltage applied on an electrode in an electrostatic attraction type inkjet head so as to control the size of droplets of ink or the volume of the ink that is ejected from the inkjet head.

The Chang reference only discloses reducing the volume of droplets ejected from an inkjet apparatus in order to increase resolution of an image to be formed. Needless to say, Chang does not disclose successively ejecting droplets from a nozzle so as to repeat ejection of the droplets onto the same organic EL layer formation region. The Hawkins reference only discloses that in an inkjet apparatus, the size of a nozzle is a result effective variable for determining the flow of ink through the nozzle and thus the droplet size.

As described above, the cited references disclose neither the object to be solved by the present invention nor the feature of the present invention that each of the droplets ejected from the nozzle of the inkjet apparatus is 1pl or less. Therefore, the subject matter of the present invention cannot be obtained by any combination of the cited references, and cannot be easily arrived at by any combination of the cited references.

Accordingly, Applicants respectfully request reconsideration of this application in view of the foregoing Amendment and Remarks, and also that this application be allowed as a result thereof.

Applicants believe that additional fees beyond those submitted herewith are not required in connection with the consideration of this response to the currently outstanding Official Action. However, if for any reason a fee is required, a fee paid is inadequate or credit is owed for any excess fee paid, you are hereby authorized and requested to charge and/or credit Deposit Account No. **04-1105**, as necessary, for the correct payment of all fees which may be due in connection with the filing and consideration of this communication.

Respectfully submitted,

Date: May 10, 2010

SIGNATURE OF PRACTITIONER

Reg. No.: 27,840

David A. Tucker
(Type or print name of practitioner)
Attorney for Applicant(s)

Tel. No. (617) 517-5508

Edwards Angell Palmer &
Dodge LLP
P.O. Box 55874
P.O. Address

Customer No.: 21874

Boston, MA 02205